CLAIMS

1. An apparatus for determining a quality measure indicative of the quality of an audio signal, the apparatus comprising:

a memory for storing a predetermined function which gives, for a given set of audio signal values, a probability density for parameters of a predetermined audio model which is assumed to have generated the set of audio signal values, the probability density defining, for a given set of model parameter values, the probability that the predetermined audio model has those parameter values, given that the model is assumed to have generated the set of audio signal values;

means for receiving a set of audio signal values representative of an input audio signal;

means for applying the set of received audio signal values to said stored function to give the probability density for said model parameters for the set of received audio signal values;

means for processing said function with said set of received audio signal values applied, to derive samples of parameter values from said probability density;

means for analysing at least some of said derived samples of parameter values to determine a quality

measure indicative of the quality of the received audio signal values.

2. An apparatus according to claim 1, wherein the said analysing means is operable to determine a measure of the variance of said at least some of said samples of parameter values in determining said quality measure.

3. An apparatus according to claim 2, wherein said probability density function is in terms of said variance measure and wherein said processing means is operable to draw samples of said variance measure from said probability density function.

4. An apparatus according to claim 1, wherein said processing means is operable to draw samples iteratively from said probability density function.

5. An apparatus according to claim 3, wherein said processing means comprises a Gibbs sampler.

6. An apparatus according to claim 3, wherein said analysing means is operable to determine a histogram of said drawn samples and wherein said quality measure is determined using said histogram.

7. An apparatus according to claim 6, wherein said analysing means is operable to determine said quality measure using a weighted sum of said drawn samples, and wherein the weighting for each sample is determined from said histogram.

8. An apparatus according to claim 1, wherein said receiving means is operable to receive a sequence of sets of signal values representative of an input audio signal and wherein said applying means, processing means and analysing means are operable to perform their function with respect to each set of received audio signal values to determine a quality measure for each set of received signal values.

9. An apparatus according to claim 8, wherein said processing means is operable to use the values of parameters obtained during the processing of a preceding set of signal values as initial estimates for the values of the corresponding parameters for a current set of signal values being processed.

10. An apparatus according to claim 8, wherein said sets of signal values in said sequence are non-overlapping.

11. An apparatus according to claim 1, wherein said audio model comprises an auto-regressive process model and wherein said parameters include auto-regressive model coefficients.

12. An apparatus according to claim 1, wherein said audio signal model includes a noise model having a noise parameter and wherein said quality measure is determined using said noise parameter.

13. An apparatus according to claim 1, wherein said received set of audio signal values is representative of an input speech signal.

14. An apparatus according to claim 13, wherein said received set of speech signal values are representative of a speech signal generated by a speech source as distorted by a transmission channel between the speech source and the receiving means; wherein said predetermined function includes a first part having first parameters which models said source and a second part having second parameters which models said channel; wherein said processing means is operable to derive samples of at least said first parameters; and further comprising means for outputting values of said first

parameters that are representative of said speech generated by said speech source before it was distorted by said transmission channel.

15. An apparatus according to claim 14, wherein said processing means is operable to determine a histogram of said derived samples and wherein said values of said first parameters are determined from said histogram.

16. An apparatus according to claim 15, wherein said processing means is operable to determine said values of said first parameters using a weighted sum of said derived samples, and wherein the weighting for each sample is determined from said histogram.

17. An apparatus according to claim 14, wherein said processing means is operable to derive samples of said second parameters and wherein said analysing means is operable to determine said quality measure using the derived samples of said second parameters.

18. An apparatus according to claim 14, wherein said function is in terms of a set of raw speech signal values representative of speech generated by said source before being distorted by said transmission channel, wherein the

apparatus further comprises second processing means for processing the received set of signal values with initial estimates of said first and second parameters, to generate an estimate of the raw speech signal values corresponding to the received set of signal values and wherein said applying means is operable to apply said estimated set of raw speech signal values to said function in addition to said set of received signal values.

19. An apparatus according to claim 18, wherein said second processing means comprises a simulation smoother.

20. An apparatus according to claim 18, wherein said second processing means comprises a Kalman filter.

21. An apparatus according to claim 14, wherein said second part is a moving average model and said second parameters comprise moving average model coefficients.

22. An apparatus according to claim 1, further comprising means, responsive to said quality measure, for comparing signals representative of the input audio signal with prestored models, to generate a comparison result.

23. An apparatus according to claim 22, wherein said signals representative of the audio signal are derived from said stored function.

24. An apparatus according to claim 1, further comprising means for encoding signals representative of the input audio signal in dependence upon the output quality measure.

25. An apparatus for generating annotation data for use in annotating a data file, the apparatus comprising:

means for receiving an audio annotation;

an apparatus according to claim 1 for generating a quality measure indicative of the quality of the received audio signal; and

means for generating annotation data using data representative of the received audio signal and said quality measure.

26. An apparatus according to claim 25, wherein said audio annotation comprises speech data and wherein the apparatus further comprises speech recognition means for processing the speech data to identify words and/or phonemes within the speech data; and wherein said annotation data comprises said word and/or phoneme data.

27. An apparatus according to claim 26, wherein said data representative of the input speech is derived using said apparatus according to claim 1.

28. An apparatus according to claim 27, wherein said annotation data defines a phoneme and word lattice.

29. An apparatus for searching a database comprising a plurality of annotations which include annotation data and a quality measure indicative of the quality of an annotation used to generate the annotation data, the apparatus comprising:

means for receiving an audio input query;

means for determining a quality measure for the input audio query; and

means for comparing data representative of said input query with the annotation data of one or more of said annotations in dependence upon the quality measure for said input query and the corresponding quality measure for the annotation.

30. An apparatus according to claim 29, wherein said data representative of said input query and said annotation data comprises word and/or phoneme data.

31. An apparatus according to claim 29, wherein said second comparing means is operable to compare said query data with said annotation data using a first comparison technique if both said quality measures exceed a predetermined threshold and is operable to compare said query data with said annotation data using a second comparison technique if either or both of said quality measures are below said predetermined threshold.

32. An apparatus for searching a database comprising a plurality of information entries to identify information to be retrieved therefrom, each of said plurality of information entries having an associated annotation and a quality measure indicative of the quality of the annotation;

means for receiving an input audio query;

an apparatus according to claim 1 for processing said input audio query to generate a quality measure therefor; and

means for comparing data representative of the input audio query with said annotations in dependence upon the quality measure of said input query and the corresponding quality measures of said annotations.

33. A method of determining a quality measure indicative

of the quality of an audio signal, the method comprising the steps of:

storing a predetermined function which gives, for a given set of audio signal values, a probability density for parameters of a predetermined audio model which is assumed to have generated the set of audio signal values, the probability density defining, for a given set of model parameter values, the probability that the predetermined audio model has those parameter values, given that the model is assumed to have generated the set of audio signal values;

receiving a set of audio signal values representative of an input audio signal at a receiver;

applying the set of received audio signal values to said stored function to give the probability density for said model parameters for the set of received audio signal values;

processing said function with said set of received audio signal values applied, to derive samples of parameter values from said probability density;

analysing at least some of said derived samples of parameter values to determine a measure of the variance of said at least some of said samples of parameter values; and

outputting a signal indicative of the quality of the

received audio signal values in dependence upon said determined variance measure.

34. A method according to claim 33, wherein said analysing step determines a measure of the variance of said at least some of said samples of parameters values in determining said quality measure.

35. A method according to claim 34, wherein said probability density function is in terms of said variance measure and wherein said processing step draws samples of said variance measure from said probability density function.

36. A method according to claim 33, wherein said processing step draws samples iteratively from said probability density function.

37. A method according to claim 35, wherein said processing step uses a Gibbs sampler.

38. A method according to claim 35, wherein said analysing step determines a histogram of said drawn samples and wherein said quality measure is determined using said histogram.

39. A method according to claim 38, wherein said analysing step determines said quality measure using a weighted sum of said drawn samples, and wherein the weighting for each sample is determined from said histogram.

40. A method according to claim 33, wherein said receiving step receives a sequence of sets of signal values representative of an input audio signal and wherein said applying step, processing step, analysing step are performed with respect to each set of received audio signal values to determine a quality measure for each set of received signal values.

41. A method according to claim 40, wherein said processing step uses the values of parameters obtained during the processing of a preceding set of signal values as initial estimates for the values of the corresponding parameters for a current set of signal values being processed.

42. A method according to claim 40, wherein said sets of signal values in said sequence are non-overlapping.

43. A method according to claim 33, wherein said audio

model comprises an auto-regressive process model and wherein said parameters include auto-regressive model coefficients.

44. A method according to claim 31, wherein said audio signal model includes a noise model having a noise parameter and wherein said quality measure is determined using said noise parameter.

45. A method according to claim 33, wherein said received set of audio signal values is representative of an input speech signal.

46. A method according to claim 45, wherein said received set of speech signal values are representative of a speech signal generated by a speech source as distorted by a transmission channel between the speech source and the receiver; wherein said predetermined function includes a first part having first parameters which models said source and a second part having second parameters which models said channel; wherein said processing step derives samples of at least said first parameters; and further comprising means for outputting values of said first parameters that are representative of said speech generated by said speech source before it

was distorted by said transmission channel.

47. A method according to claim 46, wherein said processing step determines a histogram of said derived samples and wherein said values of said first parameters are determined from said histogram.

48. A method according to claim 47, wherein said processing step determines said values of said first parameters using a weighted sum of said derived samples, and wherein the weighting for each sample is determined from said histogram.

49. A method according to claim 46, wherein said processing step derives samples of said second parameters and wherein said analysing step determines said quality measure using the derived samples of said second parameters.

50. A method according to claim 46, wherein said function is in terms of a set of raw speech signal values representative of speech generated by said source before being distorted by said transmission channel, wherein the method further comprises a second processing step of processing the received set of signal values with initial

estimates of said first and second parameters, to generate an estimate of the raw speech signal values corresponding to the received set of signal values and wherein said applying step applies said estimated set of raw speech signal values to said function in addition to said set of received signal values.

51. A method according to claim 50, wherein said second processing step uses a simulation smoother.

52. A method according to claim 50, wherein said second processing step uses a Kalman filter.

53. A method according to claim 46, wherein said second part is a moving average model and said second parameters comprise moving average model coefficients.

54. A method according to claim 33, further comprising the step of comparing signals representative of the input audio signal with prestored models to generate a comparison result and wherein said comparing step is responsive to said quality measure.

55. A method according to claim 54, wherein said signals representative of the audio signal are derived from said

stored function.

56. A method according to claim 33, further comprising the step of encoding signals representative of the input audio signal in dependence upon the output quality measure.

57. A method of generating annotation data for use in annotating a data file, the method comprising the steps of:

receiving an audio annotation;

the method according to claim 33 for generating a quality measure indicative of the quality of the received audio signal: and

generating annotation data using data representative of the received audio signal and said quality measure.

58. A method according to claim 57, wherein said audio annotation comprises speech data and wherein the method further comprises the step of using a speech recognition unit to process the speech data to identify words and/or phonemes within the speech data; and wherein said annotation data comprises said word and/or phoneme data.

59. A method according to claim 58, wherein said data

representative of the input speech is derived using said method according to claim 33.

60. A method according to claim 59, wherein said annotation data defines a phoneme and word lattice.

61. A method of searching a database comprising a plurality annotations which include annotation data and a quality measure indicative of the quality of an annotation used to generate the annotation data, the method comprising the steps of:

receiving an audio input query;

determining a quality measure for the input audio query; and

comparing data representative of said input query with the annotation data of one or more of said annotations in dependence upon the quality measure for said input query and the corresponding quality measure for the annotation

62. A method according to claim 61, wherein said data representative of said input query and said annotation data comprises word and/or phoneme data.

63. A method according to claim 61, wherein said

comparing step compares said query data with said annotation data using a first comparison technique if both said quality measures exceed a predetermined threshold and compares said query data with said annotation data using a second comparison technique if either or both of said quality measures are below said predetermined threshold.

64. A method of searching a database comprising a plurality of information entries to identify information to be retrieved therefrom, each of said plurality of information entries having an associated annotation and a quality measure indicative of the quality of the annotation;

receiving an input audio query;

using the method according to claim 33 to process said input audio query to generate a quality measure therefor; and

comparing data representative of the input audio query with said annotations in dependence upon the quality measure of said input query and the corresponding quality measures of said annotations.

65. A computer readable medium storing computer executable process steps to cause a programable computer

apparatus to perform the methods of claim 33.

66. Processor implementable process steps for causing a programmable computing device to perform the method according to claim 33.